Route to:

Return to:

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GAS ABSTRACTS

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CONTENTS

1. Gas Industry 101
2. Appliances 104
3. Combustion and Industrial Furnaces 104
4. Carbonization and Gasification 105
5. Natural Gas and Natural Gas Condensates 107
6. Petroleum and Synthetic Liquid Fuels 113
7. Analytical Methods and Tests 116
8. General and Physical Chemistry 117
10. Chemical Engineering 118
11. Process Equipment and Instrumentation 120
12. Materials of Construction 120

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1. GAS INDUSTRY

Cycling Plants

SURVEY OF CYCLING PLANTS. *Oil Gas J.* 48, 233 (1950) *April* 20.

The total capacity of the 52 cycling plants currently in operation is 7,251,800 gallons per day. The identity and location of these plants are tabulated.

J. C. Lane

Energy Comparison

ENERGY FOR PROCESS INDUSTRIES. PART I. PRODUCTION, RESERVES, LOCATION, PRICE. PART II. PROCESS INDUSTRIES FUEL AND ENERGY BILL. *Chem. Eng.* 57, 104-109 (1950) *May.*

The nation's fuel and energy situation is reviewed with accent on the demands of process industries. Of the 323 billion therms of energy supplied in 1949, coal supplied 38.5%; petroleum, 37.5%; natural gas, 19%; and water power, 5%. The quantities and costs of the energy from each source consumed by various process industries during 1947 are tabulated.

J. C. Lane

Federal Power Commission

Falck, E. WILL FPC GAS REGULATION AFFECT THE FUEL MARKETS? *Public Utilities Fortnightly* 45, 597-604 (1950) *May* 11.

The long-term trend away from coal to natural gas and oil has accelerated since the war, largely because of the disproportionate increases in the cost of coal. In the majority of the areas where it is available, natural gas sells for less per Btu than fuel oil. If the coal and oil industries are to survive the competition of natural gas, the disparity in prices will have to be resolved. The solution suggested is the normal play of free competition, the antithesis of FPC regulation of field prices for natural gas. The only alternative appears to be government allocation of fuel markets which is considered impractical if not unworkable.

J. C. Lane

Ralph, H. D. TEST OF POWER. *Oil Gas J.* 48, 133-134 (1950) *April* 20.

The current Federal Power Commission hearings to determine whether Phillips Petroleum Company is a natural gas company subject to FPC regulation is regarded as a test case of the FPC's alleged powers to regulate the arm's-length sales of natural gas to interstate pipe lines. The specific instance is Phillips' sales to the Michigan-Wisconsin Pipe Line Company. The states of Oklahoma, Kansas and New Mexico have intervened charging that the FPC seeks to usurp powers performed by the state commissions. Oklahoma has pointed out the conflict with its minimum established field price for natural gas.

J. C. Lane

Gasoline Taxes

Duff, D. M. RECORD GASOLINE TAXES. *Oil Gas J.* 48, 73-74 (1950) *April* 27.

Sixteen states imposed increased taxes on gasoline during 1949, raising the national average of state taxes to 5.11 cents per gallon from the previous high of 4.80 cents. A lull in the taxation legislation is expected in 1950, since it is an off-year for biennial state legislatures. At least 15 other states are expected to consider further increases in 1951.

J. C. Lane

Natural Gas Industry

Hilt, L. CHRONOLOGY OF THE NATURAL GAS INDUSTRY. *Am. Gas J.* 172, 29-36 (1950) *May.*

The historical highlights in the development of the natural gas industry in the United States are presented chronologically, beginning with George Washington's "burning spring" in 1775. The discovery of natural gas at Fredonia, New York in 1821 led to distribution through a wooden-log system to light nearby homes. Similar use in Ohio began in 1838, and the first industrial use was to evaporate brine in Butler County, Pennsylvania in 1840. The Fredonia Gas Light and Water Works Company was formed in 1865 and in the same year natural gas was first used for lampblack manufacture in Pennsylvania. Notable dates in the

development of the industry followed with increasing frequency, the "firsts" being suitably noted in this presentation.

J. C. Lane

Abstractor's Note: By making dates and facts readily available, this chronology should prove useful to speakers and writers on the industry's development.

Natural Gas Liquids

Thornton, D. P., Jr. OUTLOOK FOR GAS LIQUIDS INDUSTRY. *Petroleum Processing* 5, 373-376 (1950) *April.*

The total production of natural gas liquids in the Southwest is expected to decline about 10.4% in 1950 as compared with the record high of 4.74 billion gallons in 1949. Natural gasoline production is expected to drop 10.6% and LPG production 10.0%. For the first time in several years, there is a condition of overproduction and underconsumption with consequent depression in price. New gas recovery facilities installed as adjuncts to catalytic cracking units are now enabling many refiners to recover their own light ends for blending into gasoline and even to produce an excess which they are marketing in direct competition with the LPG produced by the natural gas liquids industry. Demand for LPG was down last winter because of abnormal warmth in the largest areas of consumption. Many believe that large-scale use will develop through increasing the volatility of motor fuels. Road tests have shown that this can be done without inviting serious vapor lock troubles.

J. C. Lane

Natural Gas Sales

Casper, J. C. NATURAL GAS ONLY SEGMENT OF INDUSTRY STILL FACING AN UNSATISFIED DEMAND. *Oil Gas J.* 48, 136-137 (1950) *May* 4.

Natural gas transmission facilities continue to expand, while the petroleum industry has caught up with demand. The major reason for the great natural gas demand is its low cost. While some postwar contracts have been made for natural gas at as much as ten cents per thousand cubic feet at the wellhead, crude oil would have to sell at less than sixty cents per barrel to compete on the basis of energy content at the well. Transportation cost to northern markets greatly reduces the margin between delivered prices. The cost of transporting crude oil from Texas to New York is only 10-20% of the wellhead price, while the transmission cost of natural gas is more than two times even the highest field prices now existing. Thus, changes in the field price of natural gas do not greatly affect the delivered price in the nation's potentially largest markets. Continued expansion of the natural gas industry is anticipated to satisfy the tremendous demand for low-cost, superior-convenience energy.

J. C. Lane

McIntosh, A. J. NATURAL GAS SALES TO HOLD DOWN OIL USE. *World Oil* 130, 50-51, 53-54 (1950) *May.*

Natural gas pipe lines to be completed during 1951-53 will increase delivery capacity by the equivalent of 518,000 barrels of crude oil per day. Only about half of this quantity of oil is expected to be replaced by gas, decreased use of coal also being forecast. The natural gas is expected to compete most strongly with coal and residual fuel oil, considerably with kerosine and appreciably with distillate fuel oils. The impact of increased natural gas deliveries into regional areas is illustrated in tables and charts.

J. C. Lane

Natural Gasoline

NATURAL-GASOLINE INDUSTRY'S LEADERS APPRAISE ITS PROBLEMS AND SUGGEST REMEDIAL MEASURES. *Oil Gas J.* 48, 152-156 (1950) *April* 20.

The currently inadequate market for natural gasoline stems primarily from an oversupply of crude oil and natural gasoline, loss of exports and a substantial increase in catalytic cracking capacity at refineries. Proration and a reduction of imports is suggested to rectify the oversupply. Loss of export markets is due to European dollar shortage, and even the current low price of 3.5 cents per gallon for natural gasoline does not seem sufficient inducement for foreign buyers. Catalytic cracking units are supplying refiners with the volatile ends they require for

blending into motor fuel. The laudable regulations to prevent waste of natural gas have resulted in increased production of LPG. Butane and propane must compete with other fuels in the cooking, heating and power generation fields. New and expanded uses are being developed. Underground storage for heavier winter demand is a possible step to reduce summer oversupply. An increase in the volatility of motor fuel by inclusion of more butane and natural gasoline is recommended to balance supply and demand and to conserve crude oil. The conversion of hydrogen sulfide in cycling plant sour gas to sulfur is cited as a source of potential by-product profits.

J. C. Lane

Natural Gasoline Plants

SURVEY OF NATURAL-GASOLINE PLANTS. *Oil Gas J.* **48**, 223, 225, 229-230 (1950) *April* 27.

There are currently 464 field processing plants operating in the United States to produce natural gasoline and liquefied petroleum gases from natural gas. Total capacity of these plants is 22.4 million gallons per day and cycling plants bring the natural gas liquids total to 29.6 million gallons daily, 12.7% above the capacity in 1949. The identity and capacities of the nation's natural gasoline plants are tabulated.

J. C. Lane

Privately vs. Publicly Owned Companies

Springborn, H. W. PRIVATELY OWNED GAS COMPANIES ARE MORE EFFICIENT THAN MUNICIPAL. *Gas Age* **105**, 48-49 (1950) *April* 27.

A comparison of 15 privately owned and 15 publicly owned gas companies indicates that privately owned companies operate more efficiently. The privately owned companies have a higher ratio of customers to total population, while the two types have approximately the same ratio of gas sales to number of meters. Privately owned companies operate with fewer employees. The slightly lower rates charged by municipal companies do not fully reflect their tax-free status. Detailed comparisons are presented for 12 manufactured gas, 16 natural gas and 2 LP-gas companies.

J. C. Lane

Securities

Young, H. H. MUCH IS FAVORABLE ON FINANCIAL FRONT FOR GAS INDUSTRY. *Am. Gas J.* **172**, 25-26, 63-64 (1950) *May*.

The vigorous postwar growth of the gas industry has made its securities attractive to investors. Their attention has been captured by the steps taken to develop new manufacturing processes, particularly the production of high-Btu oil gas. The news that natural gas will soon come to New England has touched off great interest in the securities of gas companies in that area. A ready demand exists for the securities of natural gas transmission and distributing companies. Companies required to offer pre-emptive purchase rights on new securities to existing stockholders, or desiring to do so, should price their offerings some 10-15% below the market price to make the rights attractive but not so low as to affect the market value of the stock. Some companies have effectively used the over-subscription privilege, allowing purchases by stockholders in excess of the pre-emptive rights subject to allotment. Funds for expansion may be accumulated by retaining earnings in the business while issuing only modest dividends. An alternative is to pay attractive dividends and raise equity money by offering more stock. The latter method is favored as creating greater interest in the company. Annual reports are the principal media for reaching the stockholders. Condensed quarterly reports are recommended.

J. C. Lane

2. APPLIANCES

Kitchen Ventilation

Hanson, E. A., Thomas, O. J. and Ashcroft, W. VENTILATION OF THE KITCHEN BY MEANS OF THE "METRO" CANOPY. *Natl. Gas Bull.* (Australia) **14**, 4-9 (1950) *January-February.*

By installing a specially designed ventilating duct above the domestic gas range the products of combustion and cooking can be vented into the attic space without the use of a ventilating fan. (This system has been designed for use in Australian climate and it appears doubtful if it has any useful value in the Northern climate of the United States.)

E. F. Davis

3. COMBUSTION AND INDUSTRIAL FURNACES

Combustion

Atkins, B. R. COMBUSTION OF PULVERIZED FUEL IN A RESONANT SOUND FIELD. *Fuel* (British) **29**, 76 (1950) *March.*

Small-scale experiments to determine the effect of resonant sound waves on the combustion rate of pulverized coal (200 microns) show 30% reduction in the time required to burn 95% of the combustible matter at a frequency of 1,800 cps. At 300 cps, the effect is slightly lower; the effect is small at 10,000 cps and imperceptible at 20,000 cps. Increasing the frequency increases the mean velocity of the particles but decreases their amplitudes. Thus, the optimum frequency imparts a sufficiently high amplitude but does not reduce velocity to the extent that turbulence is greatly reduced.

A. J. Rudnitzki

Badin, E. J. THE LOW TEMPERATURE, LOW PRESSURE, HYDROGEN ATOM INITIATED COMBUSTION OF HYDROCARBONS. *J. Am. Chem. Soc.* **72**, 1550-1553 (1950) *April.*

The combustion of hydrocarbons, initiated by H-atoms and carried out at 20° C and 0.20-0.55 mm, proceeds at the slowest rate for methane, increases for the higher paraffins and proceeds most rapidly for the olefins. The mechanism of paraffin combustion appears to involve dehydrogenation followed by peroxide formation. The reaction then leads to: (a) stabilization of the peroxide, or (b) dissociation or further reaction. Either of the above paths can be followed by the formation of CO_2, CO and other gaseous products. Whether the primary dehydrogenation step involves one or two hydrogen atoms is not clear.

A. J. Rudnitzki

Flame Propagation

Wheatley, P. J. THE PROPAGATION OF FLAMES IN TUBES. *Fuel* (British) **29**, 80-83 (1950) *April.*

The Coward and Hartwell method for burning velocities, devised for methane-air flames, is not suitable for the faster burning ethylene-air flames. The method involves the measurement of the rate of flame travel in horizontal tubes and the determination of the shape of the flame front. The present investigation shows that the faster burning ethylene-air mixtures exhibit an upright flame front, symmetrical with respect to the axis of the tube, while the slower burning mixtures have a slanting flame front. Intermediate mixtures may adopt either flame form, or may change during the course of the flame travel from an upright to a slanting flame. (The slanting form appears to be the more stable since the reverse change from slanting to upright flames has not been observed.) Thus, flames of intermediate speeds may exhibit two uniform flame speeds corresponding to the two flame forms, or a series of composite speeds compounded of the two separate flame forms in various proportions.

A. J. Rudnitzki

Gas Turbine

EXPERIMENTAL COAL-FIRED GAS TURBINE PILES UP HOURS. *Power* **94**, 80-82, 200, 202, 204 (1950) *May.*

The Locomotive Development Committee of Bituminous Coal Research, Inc. announces preliminary success in 250-hr operating experience in an experimental coal-fired gas turbine set-up which incorporates a Houdry process gas turbine unit. Auxiliary equipment developed during a broad research program includes an

air-film cooled and a ceramic-walled coal pressure combustor; a continuous, variable speed coal pump; coal pulverizer; and fly ash remover comprising a "louver" separator and cyclone separator in series. Fly ash removal has been successful to the extent that only slight visible turbine blade erosion was detected after the preliminary tests, which were conducted at temperatures somewhat lower than will be used in the coal fired gas turbine locomotive. Coincident with the prosecution of the present tests, a 4200 hp Allis Chalmers gas turbine will soon undergo extensive stationary tests at conditions anticipated for the gas turbine locomotive. A description of the flow through the equipment is included. Recognition is given to a number of research centers contributing to the coal-fired turbine development.

C. Von Fredersdorff

Research

Lewis, B. REPORT OF RESEARCH AND TECHNOLOGIC WORK ON EXPLOSIVES, EXPLOSIONS, AND FLAMES: FISCAL YEAR 1949. *U.S. Bureau of Mines Report of Investigations* 4667 (1950) *April.*

The studies conducted by the Explosives Branch of the Bureau of Mines from July 1, 1948 to June 30, 1949 are summarized. These studies include explosives research, chemical and physical tests on explosives, flame and combustion research, flammability of gases and vapors, and coal mine and dust explosions.

A. J. Rudnitzki

4. CARBONIZATION AND GASIFICATION

Ash Composition

COMPOSITION OF COAL AND COKE ASHES. *Coke & Gas* (British) 12, 127-128 (1950) *April.*

This article reviews briefly the improved analytical method for ash recently published in Fuel Survey Paper No. 50, D.S.I.R., which now supersedes paper No. 28, (1933). It also discusses the method for determination of fusing point of coal ash (British Standard Spec. No. 1016, (1942). The new paper includes revisions of methods for Fe, Ti, Mg, Mn, P, Na, K and adds methods for Ba and Li. The importance of the knowledge of the composition and fusion for furnace practice, coking, gas making and metallurgical industries is briefly discussed.

O. P. Brysch

Coal Oxidation

Chakravorty, S. L., Long, R. and Ward, S. G. FORMATION AND DECOMPOSITION OF PEROXYGEN IN LOW TEMPERATURE AIR OXIDATION OF COALS. *Fuel* (British) 29, 68-69 (1950) *March.*

Coals exposed to air at room temperature accumulate peroxygen compounds, although only to a small concentration. At higher temperatures (85°C) the peroxygen rises to a maximum with time of exposure and then decreases. High rank, low moisture coals give lower concentration of peroxygen. Upon heating the coal in an inert atmosphere, the peroxygen decomposes according to the first order reaction law, with 20 to 24 k cal/mol as energy of activation, for 1 British and 7 Indian coals.

O. P. Brysch

Coke Ovens

Taylor, A. THERMAL EFFICIENCY OF COKE OVEN BATTERIES. *Gas World* (British) 131, *Supplement* 45-51 (1950) *May* 6.

Enumeration of the various heat losses from a battery leads to the conclusion that some may be the responsibility of oven designers, but many of the factors depend upon methods of operation.

W. E. Ball

CONSETT IRON COMPANY'S COKE OVENS. *Gas World* (British) 131, 485-491 (1950) *May* 6.

Details are given of 54 Woodall-Duckham Becker Combination Underjet ovens and accessory equipment installed at the Fell Works of the Consett Iron Company, Ltd. The plant is equipped to use up to 5% coke breeze, ground in rod mills to 90% minus 1 mm.

W. E. Ball

Gas Production

Dashiell, P. T. NEW GAS-PRODUCTION PROCESSES. *Gas Age* **105**, 29-32, 72 (1950) *April* 13.

High Btu oil gas and catalytic reforming processes are discussed in their relation to the increasing supply of relatively low-cost natural gas. The author differentiates between processes in the pilot plant stage (Thermofor Pyrolytic Cracking, Fluid Bed Cracking) and the plant-scale tested processes (Single and Twin Generator and Hall Regenerative high Btu oil gas processes, continuous and cyclic catalytic reforming processes). The cyclic catalytic reforming process now in operation at the Station "K" plant of the Philadelphia Gas Works Company is discussed in detail. The advantages of reforming a part of the natural gas which becomes available and sending out an intermediate heating value gas are noted.

H. R. Linden

Odell, W. W. PROCESS AND APPARATUS FOR MAKING COMBUSTIBLE GAS. U.S. Patent 2,494,576 (1950) January 17.

Conventional gas making apparatus comprising (1) a generator containing solid fuel and (2) a regenerative heat exchanger, which serves also for reforming hydrocarbons is described. It is used to generate fuel gases by a combination of uprun and downrun (or backrun) employing several reactants such as air, steam, oxygen and hydrocarbon gases during the various portions of the proposed cycle.

C. Von Fredersdorff

Sulfur in Coke

Kipling, J. J. RETENTION OF SULFUR BY COKES AND ACTIVATED CHARCOALS. *Fuel* (British) **29**, 62-68 (1950) *March*.

One third of the total sulfur in a given binary coal blend is lost upon carbonization to a final temperature of 700°C. Steam activation of the coke at 890°C progressively removes the remaining sulfur by breakdown of the ferrous sulfide. Addition of copper compounds to the coal causes much higher retention of sulfur by formation of cuprous sulfide which is stable throughout carbonization and activation.

O. P. Brysch

THE OCCURRENCE AND ORIGIN OF SULFUR IN COKE. *Gas Times* (British) **62**, 417-418 (1950) *March* 24.

Magnetic separation and X-ray diffraction studies of the mineral matter from one high and one low-sulfur coke showed that (a) iron in the low-S coke was largely in the form of magnetic oxide and in the high S coke as magnetic iron sulfide; (b) sulfur as other sulfides was present in both; (c) sulfate sulfur apparently was present; (d) determination of S as sulfides in coke by existing chemical methods are unsatisfactory; (e) X-ray methods show promise as a means of studying the behavior of iron sulfides in coal during carbonization.

O. P. Brysch

Water in Coal

Bond, R. L., Griffith, M. and Maggs, F. A. P. WATER IN COAL. *Fuel* (British) **29**, 83-93 (1950) *April*.

The air-dried moisture content of coal has been shown to be dependent on the ambient atmospheric conditions and the particle size. The properties of the adsorbed moisture in the submicroscopic pores of coal differ greatly from those of normal liquid water. Thus, adsorbed water does not freeze even in presence of free ice at as low at —20° C, whereas water in excess of that needed for saturation of the coal froze with a definite volume change. Additional studies of water adsorption isotherms, adsorption swelling, heat of adsorption and water-coal contact angles are presented for 5 coals of several ranks.

O. P. Brysch

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Darby, H. T. SOLID AND GASEOUS FUELS. p. 116

La Violette, W. A. REMOTE CONTROL AND TELEMETERING CABLE GOES INSIDE THE GAS PIPE LINE. p. 109

Mott, R. A. THE RAPID DETERMINATION OF THE FORMS OF SULFUR IN COAL. p. 117

Wolfe, K. R. D. IMPROVED PRESSURE CONTROL METHODS STEP UP SYSTEM CAPACITIES. p. 109

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Carbon Black

Kennedy, R. E., Jones, G. W., Spolan, I. and Scott, G. S. CARBON BLACKS FORMED BY DECOMPOSITION OF MIXTURES OF ACETYLENE WITH HYDROCARBON OR OTHER GAS AT ELEVATED PRESSURES. U.S. Bureau of Mines Report of Investigations 4695 (1950) May.

This report contains data on the products of explosive decomposition of acetylene and mixtures of acetylene with other gases. Decomposition was induced in the absence of air and moisture by means of a heated filament. Primary products are carbon black, hydrogen and methane. Pressures of 10 to 125 psi were employed. Carbon yields of the order of 90% were realized.

J. D. Parent

Compressor

Carlson, R. F. IMPROVED COMPRESSOR. *Oil Gas J.* 49, 124, 126 (1950) *May* 18.

A new Worthington 1600 hp two cycle, angle compressor is described. A feature is through-scavenging whereby air is admitted at ports around the entire circumference and the exhaust is through valves in the head. This permits more effective scavenging, greater air pressure, greater fuel economy, use of cylinder liners and simpler water jacketing.

J. D. Parent

Compressor Station Design

Ames, C. B. DESIGN OF GAS-COMPRESSOR STATIONS AND DEHYDRATION PLANTS. *Oil Gas J.* 48, 86-88, 131-132 (1950) *May* 4.

Transcontinental will employ 19 compressor stations with spacings of about 80 miles. Each site is about 1,000 ft square to allow 250 ft minimum distance from the compressor building to the closest structure and to provide space for maintenance facilities and a personnel camp. Each site must have adequate soil bearing strength, drainage and water supply. Stations are constructed with basements in order to eliminate pipe trenches and to provide housing for auxiliary facilities. Care was used in selection of fittings in order to keep friction losses to a minimum. Valves are of the full-opening welding-end type. Provision is made for gas cooling, particularly for the event of possible station failure which would require high compression ratio attended by considerable heating. Many details are presented.

J. D. Parent

Corrosion

Carroll, A. J. CORROSION CONTROL IN THE COTTON VALLEY FIELD. *World Oil* 130, 141-142, 144, 146 (1950) *May*.

The results of a corrosion control program for the internal protection of field equipment in a high pressure gas condensate field are presented. Experience has shown that a program involving the use of a predetermined amount of corrosion inhibitor will be economically sound and 98% effective. The total cost of this program is approximately 50 cents per million cu ft of gas produced.

B. E. Hunt

Holloway, J. A. THE INSTALLATION AND ECONOMICS OF PLACING MAGNESIUM ANODES AT LEAKS REPAIRED ON A PIPE LINE. *Corrosion* 6, 157-161 (1950) *May*.

The use of cathodic protection will reduce the corrosion rate of anodic areas not only by polarization of the cathode but also by virtue of the IR drop through the soil from the outside current source equalizing a part of the pit driving voltage. The principal cost of anode installation is the cost of materials used since a bell hole is already present for repairing the leak. This method of leak repair will not provide complete protection but will afford a greatly reduced leakage.

B. E. Hunt

Liebman, A. J. SURFACE PREPARATION VALUES AND SANDBLASTING ECONOMICS. *Corrosion* 6, 151-157 (1950) *May*.

An outline of all suitable methods of surface preparation with emphasis on sand blasting is given. Specific surface conditions must be selected upon the basis of surface requirements and coating characteristics. When a specific

surface condition is predetermined the coating specifications may be arrived at with greater assurance of satisfactory results.

B. E. Hunt

Murray, H. D. and Crenshaw, W. H. DEVELOPMENTS IN CORROSION PREVENTION IN WEST TEXAS. *Oil Gas J.* **48**, 166-168 (1950) *April* 27.

Among the recent developments discussed, the use of inner linings and coatings and the use of cone bottom tanks with and without sumps are of great interest. Protective coatings have been applied to lease tanks, tubing, rod strings, gathering lines and main lines. Various materials of construction such as aluminum, monel, high nickel steel, and other alloy steels are being used.

B. E. Hunt

Riesenfeld, F. C. and Blohn, C. L. CORROSION PROBLEMS IN GAS PURIFICATION UNITS EMPLOYING MEA SOLUTIONS. *Petroleum Refiner* **29**, 141-150 (1950) *April*.

Severe corrosion is encountered in equipment used to remove CO_2 and H_2S from various gases with glycolamine or aqueous systems. The most critical location with regard to corrosion is the reboiler at the bottom of the regenerating still. The data obtained indicated that carbon steel and nickel steel are quite susceptible to corrosion in amine systems and that chromium-molybdenum steels, 18-8 stainless steel, and aluminum 2S and 3S are quite resistant.

B. E. Hunt

Swartout, J. M. RADIOISOTOPES AND CORROSION RESEARCH. *Petroleum Engr.* **22C**, 31-32 (1950) *April*.

A few of the corrosion problems being studied at the University of Texas Corrosion Research Laboratory are discussed. Radioactive isotopes are being used to determine sensitive spots on metallic surface and the detrimental effects of certain salts. Other problems under consideration are: gas-condensate well corrosion, the effect upon various metals of the adsorption of gases, and the effectiveness of various corrosion inhibitors.

B. E. Hunt

Wakefield, J. CORROSION PROTECTION BY METALLIZING. *Gas Age* **105**, 33-35, 74, 76, 78, 80 (1950) *March* 16.

Details of the Southern Counties Gas Company's experiences in the application of sprayed metal to pipe lines, holders, and compressors are given. The heavier metallic coating, electrochemical as well as physical protection and the better base for paint all add up to a low cost per year for protection.

B. E. Hunt

Yapuncich, J. G. TUBING CORROSION DUE TO HYDROGEN SULFIDE, ACCELERATED BY SPENT ACID. *Oil Gas J.* **48**, 68-69, 71, 90 (1950) *April* 6.

Test data on the corrosion of well tubing by hydrogen sulfide, accelerated by spent acid is reported.

B. E. Hunt

Dehydration

Buchan, R. C., Sullivan, R. J., Williams, M., and Spain, H. H. DEHYDRATION OF NATURAL GAS. *Oil Gas J.* **48**, 74, 76-77, 90, 92 (1950) *April* 6.

Types of equipment used for field dehydrating natural gas from producing wells are discussed. Methods available include (1) liquid absorption, (2) solid bed adsorption, and (3) a method in which the gas is cooled and the precipitated water is removed in line traps. The cooling required in the latter unit is accomplished by a throttling expansion of the gas to produce a cold gas at a lower pressure. The latter method seems to have merit when the gas pressure is high. A flow diagram and typical data obtained on an experimental unit of this type is presented. Charts are presented for predicting hydrate forming conditions and for estimating the temperature drop along buried gas lines.

O. T. Bloomer

Wilkinson, E. P. and Sterk, B. J. NEW DATA ON USE OF SOLID ADSORBENTS IN NATURAL GAS DRYING. Paper presented at the American Gas Association Spring Meeting of the Natural Gas Department, Tulsa, Oklahoma, May 8-9, 1950.

Sovabead is a new solid dessicant of consider-

able potential value to the natural gas industry for gas dehydration. It is a siliceous substance whose spherical shape favors low pressure drop and attrition. Resistance to fouling is also claimed. Plant scale tests on both Sovabead and activated alumina were run. Data are reported indicating considerably greater adsorption capacity for Sovabead.

J. D. Parent

Distribution

La Violette, W. A. REMOTE CONTROL AND TELEMETERING CABLE GOES INSIDE THE GAS PIPE LINE. *Gas Age* **105**, 59-64, 66, 89-90 (1950) *April* 27.

The author gives a detailed discussion of the remote control stations used in the Pacific Gas and Electric Comany distribution system in the San Francisco Bay area. A unique feature of this system is the use of the pipe line to contain the electric conduit used for the remote control and telemetering circuit.

W. G. Bair

Wolfe, K. R. D. IMPROVED PRESSURE CONTROL METHODS STEP UP SYSTEM CAPACITIES. *Am. Gas J.* **172**, 38-40, 58 (1950) *May*.

Three types of pressure regulating valves which are most useful on distribution systems handling increased loads are discussed. They are (1) the velocity type booster, commonly used on high pressure systems, which increases the reduced pressure in accordance with the load demand on the system; (2) time-temperature booster which adjusts the reduced pressure automatically in accordance with atmospheric temperature changes, and is used primarily in district regulator service; and (3) services regulators used when low pressure systems are converted to intermediate pressure. The reduction in the unaccounted for gas when the first two types are used is stressed. This is due to the lower average distribution pressure resulting when automatic pressure boosting is used.

O. T. Bloomer

Hydrocarbon Recovery Plant

McDonald, D. T. SEELIGSON FIELD PRESSURE-MAINTENANCE AND HYDROCARBON-RECOVERY PLANT. *Oil Gas J.* **49**, 78, 80, 83-84 (1950) *May* 11.

A description is given of the Seeligson field hydrocarbon-recovery plant in Wells County, Texas. The plant is rated to handle 150 MMcf per day of cycle gas and 70 MMcf of oil-well separator gas. The cycle gas is repressured for recycling while the separator gas is compressed to 1000 psi, dried and sold to a pipeline company. Unusual features include the first installation of centrifugal compressors in gasoline plant operations. Two compressors each with a capacity of 35 MMcf/day compress oilfield separator gas from 10-in. Hg vacuum to 37 psia. Waste water is disposed of by injection into salt water sands. Products include gasoline, propane, normal and iso-butane, naphtha, kerosene, mineral seal-oil.

O. T. Bloomer

Hydrogen Sulfide Removal

Connors, J. S. and Miller, A. J. OPERATING PROBLEMS RELATED TO GAS TREATING. *Gas Age* **105**, 44-47, 71-72 (1950) *March* 16.

This paper is limited to a discussion of methods for the removal of hydrogen sulfide from gas. Flow diagrams illustrating iron oxide, soda ash, phenolate, phosphate, and amine gas treating systems are presented. The operation of the iron oxide process is briefly described, and the operating problems of the amine process are discussed in detail on the basis of 10 years of first-hand experience with units ranging in capacity from 1 MMscfd to more than 160 MMscfd. Foaming was a common operating difficulty encountered and was eliminated by adding small amounts of antifoam agents such as oleyl or stearyl alcohol. Corrosion due to impurities in the scrubbing solution was found to be the principal operating problem. Some corrosive impurities resulted from the thermal decomposition and direct oxidation of the amines employed and some originated in the gas being treated. Elimination of impurities was accomplished by filtration or redistillation of scrubbing solution. This article was pre-

pared to aid in solving plant problems where treating has been difficult or where maintenance is excessive.

H. Hakewill

Metering

Cottrell, J. L. ORIFICE METERING ADAPTS ITSELF TO HIGHER PRESSURES. *Gas Age* **105**, 41-42, 95-97 (1950) *April* 27.

Flow measurements at higher and higher pressures are becoming more common, and this year flow at pressures of 8,000 psi is being metered. New construction features of the instruments are use of Teflon packing seals and non-corrosive stainless steels.

W. G. Bair

Martin, W. F. ORIFICE METER CHART CALCULATION. *Petroleum Engr.* **22D**, 17-18, 20 (1950) *May*.

Useful information on the operation of single and double line chart integrators is presented.

J. D. Parent

Natural Gasoline

Glendening, A. S. and Sanderson, C. F. PROCESSES FOR NATURAL GASOLINE PLANTS AND ASSOCIATED SYSTEMS. *Petroleum Engr.* **22C**, 54-56, 58-60 (1950) *May*.

This article contains a review of modern processes used in the recovery of natural gas liquids. Due to present low prices for propane the accent has shifted from high propane recovery to production of marketable grades of LP-gas.

J. D. Parent

Thompson, B. J. HIGH EXTRACTION EFFICIENCY AND INCREASED CAPACITY AT HAWKINS. *Petroleum Refiner* **29**, 111-114 (1950) *April*.

The extraction efficiency of the 20MMcf per day gasoline plant processing flare gas from the Hawkins oil field has been increased by recent plant extensions and revisions. The propane extraction was increased from about 55 to 85%. Extension of the plant required absorption at 500 psig instead of the original 200 psig. Other additions include lean oil refrigeration, rich oil stabilization by use of flash and reabsorber columns, and refrigeration of deethanizer reflux. A flow diagram and description of the plant are presented.

O. T. Bloomer

Odorization

Hutchison, R. M. ODORIZING NATURAL GAS. *Petroleum Engr.* **22D**, 18-20 (1950) *April*.

The "H and H Odorizer" is a combination drip and absorption type which is connected across an orifice in the gas line. The dripper is adjusted to hold the desired odor concentration at minimum flow and gas is by-passed through the absorption chamber in proportion to the main-line flow. Over a nine month period, with daily deliveries varying from 18 MM to 36 MMcf, the monthly average odorant concentration varied from 0.78 to 0.90 lb per MMcf. Operating temperatures and pressures have varied from 20 to 100°F and from 130 to 155 psi. The system cannot be flooded and there is no accumulation of heavy ends.

A. J. Rudnitzki

Pipe Lines

Attaway, D. SAFE PRACTICES IN REPAIRING GAS PIPE LINES. *Gas Age* **105**, 38-40 (1950) *April* 27.

The author describes safe methods of repairing five types of leaks commonly encountered in high pressure transmission lines. General safety precautions include use of safety clamps on the line on *all* repair jobs, use of cotton clothing instead of wool, and adequate fire extinguisher protection for the personnel. If there is any doubt as to whether the line can be repaired under pressure or not, it should be shut down.

W. G. Bair

Davidson, W. H. PIPE-LAYING METHODS ON TRANSCONTINENTAL. *Oil Gas J.* **48**, 90-91, 132-133 (1950) *May* 4.

A brief outline is presented of the construction specifications for the Transcontinental Pipe Line.

O. T. Bloomer

WESTERN "SUPER-INCH" GAS LINE OFF TO GOOD START. *Petroleum Engr.* **22D**, 7-10 (1950) *April.*

A complete description is given of the Pacific Gas and Electric Company's "Super Inch" pipe line now being constructed from California to Arizona. The 34 in. line will be 506 miles in length and will carry an ultimate 400 MMcfd. The line connects with the El Paso Natural Gas Company and will carry gas from Texas and New Mexico fields. Unusual construction features include double and triple jointing of 30 ft sections of the pipe at rail-head plants; shifting the center of gravity of the sideboom tractors to increase the lifting capacity by 30%; and the use of the world's largest trencher.

O. T. Bloomer

Production

Beard, C. S. SHELL CONVERTS ITS GAS GENERATORS TO AUTOMATIC CONTROL. *Gas* **26**, 40-42, 44 (1950) *April.*

Details are presented of the changes made in converting gas generators to automatic control. This included the following: (1) replacement of handwheel operated valves with hydraulic piston-operated valves energized by pneumatic diaphragm motor valves; (2) provision of a cycle timer to operate the various hydraulic valves by an electrical circuit; (3) provision of alarm signals; (4) provision of emergency depressurizing facilities.

W. J. Merwin

Calhoun, J. C., Jr. ENGINEERING FUNDAMENTALS: PERMEABILITY; CLAY CONTENT. *Oil Gas J.* **48**, 95 (1950) *April* 6.

A change in the permeability of rocks can result from an ion exchange between the clay in the rock sample and the fluid used for measuring the permeability. The precaution in using water on such samples is pointed out and it is suggested that water equivalent in ionic content to the original formation water be used.

O. T. Bloomer

Howard, G. C. and Fast, C. R. SIGNIFICANCE OF PUMPING RATES ON SQUEEZE CEMENTING. *Oil Gas J.* **49**, 120, 122, 124, 126, 131, 134, 138, 141, 143, 146 (1950) *May* 25.

A number of squeeze cementing problems were studied and the following results are reported. (1) The pressure at which fluid can be injected into a formation was found to be less than the theoretical overburden pressure based on 1 psi per foot. This is thought to be due to rock deformation in the vicinity of the fracture and partial support by overlying formations by beam or arch effect. (2) Cement on a squeeze job tends to flow horizontally into the formation along zones of weakness. (3) Water is preferable to mud for breakdown preceding a squeeze job. A higher percentage of effective seals were realized. (4) In order to spot cement a desired elevation it is necessary that the formation be relatively homogeneous. (5) Perforations in casing can best be plugged if a low-water-loss cement containing a circulation-preventive material is used. (6) Limitation of the quantity of cement used can often be effected by slowing or stopping the pumps for short periods after injection of the desired amount of cement in order to initiate pressure build-up. (7) The effectiveness of a squeeze job depends on the bonding between the squeezed cement and the primary cement sheath rather than on the quantity injected. (8) Both drillable and retrievable packers are satisfactory for squeeze jobs.

J. D. Parent

McLatchie, A. S. A RAPID METHOD FOR PERMEABILITY CALCULATIONS. *Petroleum Engr.* **22B**, 72, 74, 76-77 (1950) *April.*

A nomographic method for speeding the calculations of the permeability of a core sample from laboratory test data is presented. The method of constructing the nomograph is outlined and a typical nomograph is presented. The nomograph is accurate to better than 10% and corrections can be applied to increase the accuracy.

O. T. Bloomer

Remke, M. A. LARIMORE GAS INJECTION PROJECT. *World Oil* 130, 164-166 (1950) *May.*

The production history of the Larimore pool in north central Texas is reviewed. Gas repressuring of this pool was begun before development was complete. From production performance curves and other reservoir data it is estimated that 56½% of the stock tank oil has been recovered to date. Primary recovery is estimated to be 35%. Permeability and porosity of the reservoir is unusually high.

O. T. Bloomer

Weinaug, C. F. EFFECT OF RESERVOIR ROCK ON VAPOR-LIQUID EQUILIBRIUM. *World Oil* 130, 175, 180 (1950) *May.*

The author attempts to harmonize the recent reports of Calhoun et al and of Weinaug and Cordell. The Calhoun report indicates lowering of vapor pressure by placement in fine capillaries while the Weinaug report indicates no effect. It is indicated that Calhoun's sand had finer pores than Weinaug's and that in reservoirs the finer capillaries are filled with water leaving the coarser ones for hydrocarbon so that the surface effect on vapor pressure should be very small for actual reservoirs.

J. D. Parent

Whorton, L. P. and Kieschnick, W. L., Jr. PRELIMINARY REPORT ON OIL RECOVERY BY HIGH-PRESSURE GAS INJECTION. *Oil Gas J.* 48, 78, 82, 84, 86-89 (1950) *April* 6.

This is a preliminary report on the new oil recovery process recently announced by Atlantic Refining Company. Background leading to the development of the process is discussed, and the results of preliminary laboratory tests designed to test its effectiveness are presented. The laboratory work included static and also dynamic displacement experiments. In this process, gas at pressures significantly higher than those used in the conventional low pressure gas sweep are used. Prerequisites are: (a) high pressure (in excess of 3000 psia); (b) large volumes of gas; (c) small amount of channeling in the formation; and (d) significant concentrations of intermediates (ethane through heptane) in the reservoir fluid. The mechanism of additional recovery is governed by: (a) the retrograde solution in the gas of intermediate boiling hydrocarbons; (b) the subsequent solution of the gas in the downstream oil with attendant swelling of the oil to a high volume; and (c) the viscosity changes resulting from the enrichment of the gas and the swelling of the oil. This enhances displacement efficiency. Recoveries as high as 80% of the oil in place are indicated from the results of the dynamic displacement experiments.

O. T. Bloomer

Reserves

Lahee, F. H. OUR OIL AND GAS RESERVES: THEIR MEANING AND LIMITATIONS. *Calif. Oil World* 43, 3-5, 31 (1950) *April,* 2nd issue.

The meaning of oil and gas reserve estimates is frequently misinterpreted by a failure to properly define the terms employed. Reserves estimated in pools adequately delimited by producing wells are termed *drilled proved reserves.* Reserves estimated on the basis of proximity to drilled areas are termed *undrilled proved reserves.* Where geological and geophysical studies indicate further extension of a field the estimated reserves are termed *discovered* but not *proved.* Additional oil which may be eventually obtained through secondary recovery operations is spoken of as *discovered possible reserves,* but is not regarded as proved until tests have indicated the extent of recovery obtainable. The fact that annual additions to proved reserves through extensions and revisions of earlier estimates generally exceed by several times those resulting from the discovery of new fields or new pools in old fields indicates a conservative approach toward the estimation of proved reserves.

J. C. Lane

Storage

Mosteller, W. C. TRANSMISSION LINE TYPE STORAGE...CAPACITY CALCULATIONS AND COSTS. Paper presented at the Natural Gas Department Meeting of the American Gas Association, Tulsa, Oklahoma, May 8-9, 1950.

This is a rather extensive report covering the

cost of transmission line type of storage vs. other types of storage. Included is a procedure for computing storage in a flowing line.

J. D. Parent

Transmission

Armstrong, E. N. MEASUREMENT AND PRESSURE CONTROL OF NATURAL GAS ON THE TRANSCONTINENTAL GAS PIPE LINE SYSTEM. *Oil Gas J.* 48, 122, 124, 126, 128, 130-131 (1950) *May* 4.

A complete description is given of gas measurement and pressure control equipment to be used on the Transcontinental Gas Pipe Line System. Except for two large sales meter stations all purchase and sales meter stations will be of standardized design and will be shop fabricated. Many design details are included in the article. Special consideration has been given to temporary regulator trouble expected when starting up the line, to tight shutoff pressure regulating valves at intermittent delivery stations, and to pressure regulation at gas plants where flow is intermittent.

O. T. Bloomer

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Catalysts

Fast, E. SPECTROGRAPHIC DETERMINATION OF POTASSIUM IN IRON CATALYSTS BY FRACTIONAL DISTILLATION. *Anal. Chem.* 22, 320-322 (1950) *February.*

A spectrographic method for the analysis of the potassium content of the iron-potassium catalysts used in ammonia and Fischer-Tropsch synthesis is described. A low current D.C. arc excitation source burns in two distinct stages, consuming the potassium completely before the appearance of the strongly interfering iron spectrum. The average deviation is 5 to 10% of the total potassium. The method is also applicable to sodium and lithium.

S. Katz

Weller, S., Pelipetz, M. G., Friedman, S., and Storch, H. H. COAL HYDROGENATION CATALYSTS: BATCH AUTOCLAVE TESTS. *Ind. Eng. Chem.* 42, 330-334 (1950) *February.*

A survey of many catalysts and combinations for the hydrogenation of coal was conducted in batch, autoclave tests. The standard test was one-hour reaction time at 842° F with 1000 psi initial hydrogen pressure. No vehicle was used. A glass liner was used in the autoclave to eliminate "memory" effects. Ammonium chloride alone showed no action and tin alone showed only moderate activity. The combination of tin plus halogen acid (ammonium chloride) showed a remarkable synergism and constitutes the best known catalyst for coal hydrogenation. Zinc is also effective with ammonium chloride and 90% of the tin can be replaced by zinc without loss of activity. The physical condition of the tin is important, but, if it is well distributed, stannous sulfide, metastannic acid, tin tetraphenyl and tin itself are equally effective in combination with ammonium chloride. As the halogen acid, ammonium chloride, hydrochloric acid, carbon tetrachloride and the chloracetic acids were all essentially equivalent as promoters for tin. Germanium seems to be the only element of the periodic table which compares favorably with tin, but is even less available for industrial use. Iron compounds were useless at 1000 psi pressure, but at 3700 psi, iron catalysts, such as ferrous sulfate, pyrite and "red mud," can be used to good effect. However, they are considerably less effective than the tin-ammonium chloride combination.

C. H. Riesz

Weller, S., Clark, E. L., and Pelipetz, M. G. COAL HYDROGENATION CATALYSTS: MECHANISM OF COAL HYDROGENATION. *Ind. Eng. Chem.* 42, 334-336 (1950) *February.*

A descriptive theory of coal hydrogenation is presented on the basis of the influence of catalysts on the hydrogenation of bituminous coal and asphalt. It is postulated that coal (or asphalt) is split to form reactive fragments, the splitting being catalyzed by halogen acids. The fragments either polymerize to form benzene-insoluble products or are stabilized by the

addition of hydrogen to form benzene-soluble liquids. The hydrogenation is catalyzed by tin. The production of hydrocarbon gases appears to be random and independent of the nature of the catalyst.

C. H. Riesz

Fischer-Tropsch Synthesis

Hengstebeck, R. J. CATALYTIC CONVERSION. U. S. Patent 2,493,917 (1950) January 10.

In order to control the temperature of an exothermic catalytic reaction, such as the hydrogenation of carbon monoxide to form hydrocarbon liquids, a permeable annular bed of solid catalyst is rotated on its axis in a horizontal plane. Part of the bed is submerged in an inert liquid which serves to control the temperature of reaction while reacting gases pass through the unsubmerged portions of the bed. The rate of rotation is made sufficient to prevent overheating of the catalyst.

C. H. Riesz

Kemp, L. C., Jr. COMBINATION PROCESS FOR THE HYDROGENATION OF CARBON MONOXIDE AND THE PRODUCTION OF AMMONIA. U.S. Patent 2,494,561 (1950) January 17.

A finely divided iron catalyst (100 to 300 mesh) promoted with potassium oxide and alumina is used as a fluidized catalyst for (1) synthesis of ammonia from nitrogen and hydrogen at 150 to 400 atmospheres pressure and (2) after loss in reactivity, for the hydrogenation of carbon monoxide at 10 to 30 atmospheres pressure.

C. H. Riesz

Gaseous Mixture Separation

Roberts, I. SEPARATION OF TERNARY GASEOUS MIXTURES CONTAINING HYDROGEN AND METHANE. U.S. Patent 2,495,549 (1950) January 24.

A method is claimed for the separation of hydrogen and methane from a ternary mixture containing an intermediate boiling constituent such as carbon monoxide using apparatus comprising a single low pressure distillation column and means for three stage cooling of feed gases. The operation is based on (1) separation of hydrogen by condensation of the remaining constituents and (2) simple rectification of the resultant binary mixture.

C. Von Fredersdorff

Hydrocarbons

Glasgow, A. R., Jr., Willingham, C. B., and Rossini, F. D. HYDROCARBONS IN THE 108° TO 116° C FRACTION OF PETROLEUM. *J. Research Natl. Bur. Standards* **44**, 141-146 (1950) *February.*

This report describes the analysis of the hydrocarbons in the 108° to 116° C aromatic-free fraction of petroleum, which is shown to be composed of eleven hydrocarbon compounds, of which three are present only in very small amount. For these eleven compounds, the normal boiling points (of high purity samples not from the present investigation) and the estimated amounts by volume in the original Ponca, Okla., crude petroleum are as follows: 2,5-dimethylhexane, 109.11° C, 0.055 percent; 1, *trans*-2,*cis*-4-trimethyl-cyclopentane, 109.28° C, 0.22 percent; 2,4-dimethylhexane, 109.43° C, 0.055 percent; 2,2,3-trimethylpentane, 109.84° C, 0.004 percent; 1,trans-2,cis-3-trimethylcyclopentane, 110.4° C, 0.26 percent; 3,3-dimethylhexane, 111.97° C, 0.03 percent; 2,3,4-trimethylpentane, 113.47° C, 0.005 percent; 1,1,2-trimethylcyclopentane, 113.72° C, 0.06 percent; 2,3,3-trimethylpentane, 114.76° C, 0.006 percent; 2,3-dimethylhexane, 115.61° C, 0.06 percent; and 2-methyl-3-ethylpentane 115.65° C, 0.04 percent.

Authors' abstract

Lowry, R. A. PURIFICATION OF AND THE DETERMINATION OF THE PHYSICAL PROPERTIES OF HYDROCARBONS. *J. Inst. Petroleum* (British) **36**, 80-88 (1950) *February.*

The present paper discusses another aspect of hydrocarbon synthesis, namely the purification and characterization of hydrocarbons. The purification of hydrocarbon varies both with the individual hydrocarbons and also with the method of preparation. Since hydrocarbons are less prone to form solid derivatives, the major-

ity of methods used for their purification are purely physical in character. The most widely employed processes depend on distillation, and fractionation in high efficiency columns. Other types of distillation available for purification are azeotropic and extractive distillation. Another extremely valuable method of purification is fractional crystallization. Important physical constants for the purpose of identification and comparison of hydrocarbons are refractive index, density, boiling point, and freezing point. The greater use of the freezing point determination is in the estimation of purity. Dr. F. D. Rossini and co-workers have developed a method for determining the absolute purity of a sample from a time-temperature freezing curve. Mention is made of spectroscopic data for identifying hydrocarbons and showing the presence of impurities.

M. C. Miyaji

Hydrogen Production

Ipatieff, V. N., Monroe, G. S., and Fischer, L. E. LOW TEMPERATURE HYDROGEN PRODUCTION. *Ind. Eng. Chem.* 42, 92-94 (1950) *January.*

The conversion of methane and steam into hydrogen, carbon dioxide and relatively small amounts of carbon monoxide in the presence of nine different catalysts is described. The most active compositions consisted of nickel-kieselguhr and nickel-copper-kieselguhr. Catalysts containing either alumina or magnesia as carriers were relatively inactive. Over a temperature range of 900° to 1185° F and at atmospheric pressure, a five-to-one mole ratio of steam-to-methane gave 200-400% of hydrogen with a methane conversion of 52-91%. When the operating pressure was raised to 250 psig, it was found that the steam-to-methane ratio must be increased to 31-to-1 to obtain the hydrogen yields and methane conversions which were about the same as at atmospheric pressure. However, the carbon monoxide-to-carbon dioxide ratio was simultaneously decreased as much as ten-fold. Comparative life tests at atmospheric pressure and at 250 psig indicated that the life of the catalyst was short at the higher pressure. Addition of copper as promoter improved the life of the catalyst at elevated pressure.

C. H. Riesz

Hydrogenation

Clarke, E. A., Chaffee, C. C. and Hirst, L. L. HYDROGENATION OF PETROLEUM AND LIGNITE TAR DISTILLATES. U.S. Bureau of Mines Report of Investigations 4676 (1950) April.

The data and experience gained during the first 700-atmosphere operation of the Bureau of Mines demonstration plant at Louisiana, Missouri, is described. From April 8 to 16, 1949, first petroleum oil and then coal tar distillate were hydrogenated in the vapor phase hydrogenation section of the plant. Illustrative of the technical operating difficulties encountered was the requirement of two months to cold test with nitrogen to isolate leaks and to tighten the plant. Equipment failures, faulty operation, and some unsolved problems in control occurring during the 8-day test are described.

C. H. Riesz

Elliott, M. A. Kandiner, H. J., Kallenberger, R. H., Hiteshue, R. W. and Storch, H. H. HYDROGENATION OF BITUMINOUS COAL IN EXPERIMENTAL FLOW PLANT. *Ind. Eng. Chem.* 42, 83-91 (1950) *January.*

Coal-oil pastes were treated with hydrogen at temperatures of 788-896° F and contact times ranging from 1 to 80 minutes. The effects of several catalysts at different concentrations were evaluated. The nature of the products was correlated with the changes in variables. The experimental flow plant used is described.

C. H. Riesz

Power Plants

Hicks, T. G. POWER PLANTS FOR MODERN REFINERIES. PART III. *Petroleum Refiner* 29, 143-145 (1950) *May.*

Waste heat boilers and generation of steam from process operations are discussed. The necessity of careful design to obtain the proper balance between steam production and power generation is stressed. The generation of power with gas turbines and gas expansion turbines is also briefly discussed.

O. T. Bloomer

Synthetic Liquid Fuels

Torrey, P. D. POSSIBILITIES FOR PRODUCTION OF LIQUID FUELS FROM SHALE, NATURAL GAS, AND COAL. Part II. *Petroleum Engr.* 22A, 45-46, 48 (1950) *April.*

The economics of coal hydrogenation is reviewed. In summarizing the production of synthetic liquid fuels, the factor of increasing production costs as oil fields become depleted is emphasized. It is probable that the costs of oil from shale or from coal hydrogenation will remain fixed over a long period of time if located near to abundant supplies of raw materials. Another factor not usually recognized is that the synthetic product is not the equivalent of crude petroleum, but should have some special advantages. Thus, synthetic fuels should supplement rather than compete with petroleum. The social and political implications of the use of our natural resources will exert great influence upon a synthetic fuel industry. The activity of government in preliminary exploration of methods and techniques should prove helpful, but the development of plants should conform to our needs for supplemental supplies of liquid fuels without interference by government controls.

C. H. Riesz

7. ANALYTICAL METHODS AND TESTS

Carbon and Hydrogen

Belcher, R. and Ingram, G. A RAPID MICRO-COMBUSTION METHOD FOR THE DETERMINATION OF CARBON AND HYDROGEN. *Analytica Chimica Acta* 4, 118-129 (1950) *April.*

Based on the earlier work of Belcher and Spooner and of Ingram, using the "empty tube" technique, a new type of combustion apparatus has been designed. The combustion zone of the tube consists of a vertical, double surface chamber heated by a special type of split furnace. The purification system has been specially designed to allow replacements to be readily effected. Sulfur oxides and halogens are absorbed on heated silver, and nitrogen oxides by an external absorbent. The whole assembly is small and compact and only takes up 51 x 23 cm of bench space without attachment of the three absorption tubes. The combustion may be completed in 10 minutes.

Authors' summary

Fuels

Darby, H. T. SOLID AND GASEOUS FUELS. *Anal. Chem.* 22, 227-234 (1950) *February.*

The author reviews recent advances in methods of analysis of solid and gaseous fuels. The section on coal, coke, wood charcoal, and briquets discusses sampling, proximate analysis, ash softening temperature, ultimate analysis, calorific value, plastic behavior on carbonization, determination of expansion and carbonizing pressure, carbonization tests, strength of coal, density, reactivity, and miscellaneous tests. The section on gaseous fuels discusses conventional complete analysis, sampling and samplers, and apparatus. Methods for tar, light oils, benzene, toluene, and xylene are briefly discussed.

H. Hakewill

Gas Analysis

Miller, C. A. GAS ANALYSIS. A REVIEW OF ARTICLES PUBLISHED DURING 1947. *J. Inst. Petroleum* (British) 36, 164-183 (1950) *March.*

Literature relating to conventional physical and chemical methods of gas analysis is reviewed in some detail. Spectroscopic methods of analysis, however, are excluded from consideration. Physical methods considered include: distillation, thermal conductivity, colorimetric reactions, paramagnetism, heat of reaction, and specific diffusion. Chemical methods for the determination of carbon monoxide, acetylene, butadiene, and oxygen are also discussed. A bibliography containing 34 references to source material is appended.

H. Hakewill

Sulfur

Mott, R. A. THE RAPID DETERMINATION OF THE FORMS OF SULFUR IN COAL. *Fuel* (British) 29, 53-61 (1950) *March.*

A historical survey of methods developed for determining the forms of sulfur in coal and a comparison of techniques of, and results obtained by, the various methods is given. After further experimental work on the effects of mechanical shaking, temperature, coal particle size, and contact time on the selectivity and efficiency of extraction, rapid methods were developed for the routine determination of sulfate, pyritic, and organic sulfur in coal.

H. Hakewill

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Feller, M. and McDonald, H. J. DETERMINATION OF LIQUID-VAPOR EQUILIBRIA: NEW DEW POINT-BUBBLE POINT APPARATUS. p. 117

COMPOSITION OF COAL AND COKE ASHES. p. 105

THE OCCURRENCE AND ORIGIN OF SULFUR IN COKE. p. 106

8. GENERAL AND PHYSICAL CHEMISTRY

Density Determination

Hidnert, P. and Peffer, E. L. DENSITY OF SOLIDS AND LIQUIDS. U.S. National Bureau of Standards Circular 487 (1950) March 15.

Density data may be used for obtaining relationships between density, chemical composition, thermal and mechanical treatments of materials, etc. This circular defines density and specific gravity, describes 11 methods (hydrostatic weighing, picnometer, flotation, hydrometer, falling drop, balanced column, Boyle's law, electromagnetic, elastic helix, ice calorimeter, and volumetric) for determinations of the densities of solids and liquids, and indicates the accuracy of various methods.

Authors' abstract

Liquid-Vapor Equilibria

Feller, M. and McDonald, H. J. DETERMINATION OF LIQUID-VAPOR EQUILIBRIA: NEW DEW POINT-BUBBLE POINT APPARATUS. *Anal. Chem.* 22, 338-340 (1950) *February.*

A new form of dew and bubble point apparatus for use with binary systems which are liquid at room temperature and moderate pressures is described. Applications to molecular weight determinations, analysis, and the study of ternary systems are discussed.

S. Katz

Membrane Equilibria

Flood, E. A. and Benson, G. C. MEMBRANE EQUILIBRIA, THE GIBBS-DALTON LAW AND THE ENTROPY OF MIXING. *Canadian J. Research* 27B, 988-1014 (1949) *December.*

The ideas underlying membrane equilibria are discussed in detail and a number of apparent anomalies are indicated. It is shown that when two gases obey Dalton's law of mixing, it is thermodynamically possible for the pressure of one to increase while the other diminishes, as well as the more familiar case of both pressures decreasing (chemical reaction). Further, it is stated that there is no thermodynamic requirement that different kinds of molecules in ideal gas systems shall have the same mean translatory kinetic energy.

S. Katz

Oxygen

Keilin, D. and Hartree, E. F. ABSORPTION SPECTRUM OF OXYGEN. *Nature* (British) 165, 543-545 (1950) *April* 8.

The existence of a range of visible absorption in the spectrum of oxygen is noted, either at elevated pressures or in the liquid phase.

S. Katz

Thermal Expansion

Hidnert, P. and Souder, W. THERMAL EXPANSION OF SOLIDS. U. S. National Bureau of Standards Circular 486 (1950).

Detailed experimental methods used in determining the thermal expansion of solids, meth-

ods used in obtaining the thermal expansion equation from the obtained data as a function of temperature, correlation of this property to other physical properties of the solids, and a few applications of thermal expansion properties to industry are described in this paper.

S. Mori

Thermodynamics

Kobe, K. A. and Long, E. G. THERMOCHEMISTRY FOR THE PETROCHEMICAL INDUSTRY. PART XI. CYANOGEN COMPOUNDS. *Petroleum Refiner* 29, 89-92 (1950) *May.*

The eleventh in the series of articles on thermal properties of various compounds deals with the cyanogen groups. As previously, tables on most reliable sources of data references, heats of formation and combustion, free energies of formation, heat capacities and enthalpies on four temperature scales between 0 and 1200°C or their equivalents, mean heat capacities, and the cubical heat capacities equations as a function of temperature for each of the cyanogen group are presented.

S. Mori

Koehler, W. F. THE RATIO OF THE SPECIFIC HEATS OF GASES, C_p/C_v, BY A METHOD OF SELF-SUSTAINED OSCILLATIONS. *J. Chem. Phys.* 18, 465-472 (1950) *April.*

Rüchardt has described the determination of the ratio of specific heats of gases, C_p/C_v, by the measurement of self-sustained oscillations in a tube filled with the gas. The present paper gives a rigorous series of calculations justifying the procedure and analyzing the significance of the experimental terms. Determinations of C_p/C_v for a number of gases are reported and are compared with the values in the literature.

S. Katz

Viscosity Equation

Wilke, C. R. A VISCOSITY EQUATION FOR GAS MIXTURES. *J. Chem. Phys.* 18, 517-519 (1950) *April.*

A viscosity equation of the Sutherland type applicable to binary and multi-component gas systems has been developed. The correlation gives remarkable agreement with experiment, especially when applied to binary systems. Agreement is poorest with systems involving the inert gases.

S. Katz

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Badin, E. J. THE LOW TEMPERATURE, LOW PRESSURE HYDROGEN ATOM INITIATED COMBUSTION OF HYDROCARBONS. p. 104

Fast, E. SPECTROGRAPHIC DETERMINATION OF POTASSIUM IN IRON CATALYSTS BY FRACTIONAL DISTILLATION. p. 113

10. CHEMICAL ENGINEERING

Air Flow

Arthur, J. R., Linnett, J. W., Raynor, E. J. and Sington, E. P. C. THE FLOW OF AN AIR STREAM THROUGH A LAYER OF GRANULES. *Trans. Faraday Soc.* (British) 46, 270-281 (1950) *April.*

The pressure drop as represented by the Kozeny equation for packed columns was checked experimentally and found adequate in a relative sense, although the magnitude of the constant term was considered unpredictable. The distribution of air flowing through packed beds was checked experimentally and found greatest near the walls, as has been reported by others.

J. D. Parent

Distillation

Colburn, A. P. AZEOTROPIC AND EXTRACTIVE DISTILLATION. *Can. Chem. Process Ind.* 34, 286-297 (1950) *April.*

Many liquid mixtures are difficult to separate because of very low relative volatility or even azeotrope formation. Azeotropic or extractive distillation may provide a solution. This involves use of an additional liquid which by non-ideal behavior increases the relative volatility. The purpose of the article is to point out how the additive is to be selected. Use of

activity coefficient data for binary systems for computing the properties of more complex systems is said to be accurate and relatively simple.

J. D. Parent

Logarithmic Vectors

Burrows, W. R. EIFFEL'S LOGARITHMIC VECTORS SOLVE PIPING FLOW PROBLEMS. *Heating, Piping, Air Conditioning* **22**, 77-80 (1950) *March; ibid* 94-98 (1950) *April.*

Many equations in engineering involving several variables must be solved by trial and error procedures for one of the variables when the other variables are known. To meet this difficulty Eiffel developed the method of logarithmic vectors for solving such problems graphically. This is stated to be the only presentation of the method in English. In part I the theory of logarithmic vectors is developed and the details of constructing the necessary charts are explained. In part II the method is illustrated by using the method to solve the problem of steady flow in horizontal pipes. A vector chart suitable for engineering use is presented for this case.

O. T. Bloomer

Mass Transfer

Laddha, G. S. and Smith, J. M. MASS-TRANSFER RESISTANCES IN LIQUID-LIQUID EXTRACTION. *Chem. Eng. Progress* **46**, 195-202 (1950) *April.*

Individual film resistances in liquid-liquid extraction have been obtained for the systems isobutyraldehyde-water and 3-pentanol-water using a 2 in. column with 4.2 ft effective height in the former case and 2.2 ft in the latter. The column was operated as a spray tower, packed with $^1/_4$ in. Raschig rings, and packed with $^3/_8$ in. Raschig rings. Each component was used alternately as the continuous and discontinuous phase. No third component was used in the study, each liquid partially saturating the other. The concentration of the dissolved solute liquid was used as a measure of the resistance to diffusion in that phase, since its concentration in the other phase is nearly 100 per cent and the resistance here essentially zero. Results were calculated as H.T.U. values. The H.T.U. of the discontinuous phase was found to be nearly independent of variations in the flow rate of either the continuous or discontinuous phase and of the three types of column operation. H.T.U. of the continuous phase was correlated by a constant times the mass velocity ratio of continuous to discontinuous phase raised to a power. H.T.U. values for spray operation are about 25% higher than those for the $^1/_4$ in. packing, values for the $^3/_8$ in. packing varying between the other two operations.

C. L. Tsaros

Maisel, D. S. and Sherwood, T. K. EFFECT OF AIR TURBULENCE ON RATE OF EVAPORATION OF WATER. *Chem. Eng. Progress* **46**, 172-175 (1950) *April.*

A study has been made of turbulence in a gas stream and its effect on mass transfer. Turbulence is characterized by its scale, which is a measure of the size of the eddies, and intensity, which is a measure of velocity fluctuations at a point in the stream, expressed as the mean of the deviation from the average velocity divided by the average velocity. Measurements were made using a special hot-wire turbulence meter. Measurements of evaporation from spheres and cylinders were made to observe the effect on mass transfer. Pipe-line turbulence intensity was about 3.5%, and this was increased to 24% by the use of perforated plates placed at various distances from the test object. As the Reynolds number increases, the effect of an increased turbulence intensity is more pronounced. Scale of turbulence apparently has little effect.

C. L. Tsaros

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Ipatieff, V. M., Monroe, G. S. and Fischer, L. E. LOW TEMPERATURE HYDROGEN PRODUCTION. p. 115

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Meter

Bourne, H. G., Jr. and Wunderle, J. A. AN ORIFICE-VARIABLE-AREA METER FOR SMALL AIR FLOW MEASUREMENT. *Heating & Ventilating* **47**, 77-79 (1950) *April.*

An orifice-variable-area meter is described for measurement of small air flow of the order encountered in atmospheric sampling. The orifice meter consists of three monel metal parts —an orifice plate and two flanged tubes. Pressure taps are located one pipe diameter upstream and one-half diameter downstream, with connections to the indicating element made with brass pressure fittings and one-fourth inch methacrylate tubing. The ratio of orifice diameter to the inside pipe diameter was found to be approximately 0.50 for a flow of 1.0 cfm. Interchangeable orifice plate makes it possible to measure a wide range of flows. The indicating element is a variable-area meter which is commercially available. The metering device is applied to the electrostatic precipitator and two types of filter paper collecting devices.

M. C. Miyaji

Plant Construction Costs

Brooks, G. E. HOW TO ESTIMATE PLANT CONSTRUCTION COSTS. *Petroleum Engr.* **21C**, 21-22, 24, 26-27 (1950) *April.*

In the second article of this series, the method of making a preliminary cost estimate is discussed. Before proceeding it is necessary to review available cost data. The Engineering News Record and the Marshall-Stevens index are recommended by the author for prorating known past costs to present day costs. An example is presented showing the steps followed in making cost estimates for a proposed refinery expansion program.

W. J. Merwin

Water-Cooling Towers

Degler, H. E. WATER-COOLING TOWERS. PART II. TYPES AND CONSTRUCTION. *Petroleum Engr.* **21C**, 15-16, 18, 20 (1950) *April.*

In the second article of this series, the author discusses the types and construction of water cooling towers. The items discussed include natural draft cooling towers, mechanical draft tower and finned tube dry cooling unit. The mechanical draft towers may be either spray filled or filled with wood lattice work. The fans may be placed either in the entering air or in the exit air. Pictures and drawings of the various types are presented.

W. J. Merwin

12. MATERIALS OF CONSTRUCTION

Metals and Refractories

Campbell, J. B. METALS AND REFRACTORIES COMBINED IN HIGH-TEMPERATURE STRUCTURAL PARTS. *Materials & Methods* **31**, 59-63 (1950) *May.*

Of the recently developed metal-ceramic high refractory material, the most important are the carbides, oxides and borides. These refractories combine the high resistance to thermal shock of metal with the high melting point of the refractory ceramics and are especially suitable for structural material in rockets and gas turbines. The author also describes briefly other properties of these materials. Their availability at present is limited to small and simple parts.

S. Mori

Smith, G. V. PROPERTIES OF METALS AT ELEVATED TEMPERATURES—I. *Combustion* **21**, 65-67 (1950) *April.*

The matter of metal strength at elevated temperatures, the working stresses which may be applied, the rate at which they may be applied, and the relation between time for rupture and stresses are discussed. A typical design chart for a stainless steel is also given.

B. E. Hunt

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